NOTICE

THIS DOCUMENT HAS BEEN REPRODUCED FROM MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED IN THE INTEREST OF MAKING AVAILABLE AS MUCH INFORMATION AS POSSIBLE

CR- 16/704



SPACE FABRICATION DEMONSTRATION SYSTEM QUARTERLY PROGRESS REPORT NO. 10 September 16, 1979 - December 15, 1979 NASA-MSFC Contract NAS8-32472

(NASA-CR-161704) SPACE FABRICATION DEMONSTRATION SYSTEM Quarterly Progress Report, 16 Sep. - 15 Dec. 1979 (Grumman Aerospace Corp.) 11 p HC A02/MF A01 CSCL 22A G3/12 21130

N81-21095

Unclas



CSS-SFDS-IROO1 Contract MAS8-32472 January 3, 1980

Mational Aeronautics and Space Administration George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812

Attention: Erich E. Engler, COR

Code EP-13 Bldg. 4610

Subject: SPACE FABRICATION DEMONSTRATION SYSTEM -

Quarterly Progress Report No. 10

September 16, 1979 - December 15, 1979

References: (a) SFDS Monthly Progress Letter No. 21

September 16, 1979 - October 15, 1979

(b) SFDS Monthly Progress Letter No. 22 October 16, 1979 - November 15, 1979

Enclosure: (1) SFDS Induction Fastening

SUMMARY

During this reporting period, the Space Fabrication Demonstration System (SFDS) program activity included:

- o Composite Beam Cap Fabricator This development effort, conducted at Goldsworthy Engineering Incorporated was completed within cost and close to the objectives of the abbreviated goals agreed to July 18, 1979 at MASA-MSFC. The final review meeting was held October 24, 1979. Detail associated with the above is detailed in previous monthly and quarterly reports including references (a) and (b). The final report submitted November 30, 1979.
- o Flight Experiment Analysis This effort directed at design and analysis of flight weight primary and secondary beam builder structure has proceeded according to plan. The effort has currently been curtailed due to funding limitations imposed with the authority to proceed August 1, 1979. Mechanical and structural preliminary

design layouts and the subsystems requirements document are being completed. Details of these items have been reported in references (a) and (b). Without additional funding, this effort will be terminated during the next reporting period.

o Induction Fastening - These efforts implemented during this quarterly reporting period have proceeded satisfactorily within cost and schedule. Details are included in references (a) and (b) as well as enclosure (1).

The periodic telecons and meetings between cognizant program personnel have continued to assist in timely problem definition, discussion and resolution. These have definitely been instrumental in keeping the program on target in achieving process development and general beam builder objectives within cost.

DISCUSSION

WBS 1.1 PROGRAM MANAGEMENT

Figure 1 remains unchanged from that reported in reference (b). We continue to wait for NASA-MSFC direction on final process forming and fastening demonstrations, and structural testing of these or acceptance of the final report on the Composite Beam Cap Fabricator development effort submitted November 30, 1979.

Figure 2 shows that the efforts associated with the Flight Experiment Analysis is on schedule. As noted above, we have curtailed this effort at this point and will not proceed beyond the completion of the preliminary mechanical and structural design layouts and subsystems requirements document. Any further effort will be held in abeyance until additional funding is released toward this contract effort. Consequently, the effort completion date will also slip on a month by month basis.

Figure 3 shows that the effort planning for the Induction Fastening effort is on schedule. This effort, detailed in references (a) and (b) and enclosure (l), is within target cost.

WBS 1.2 DESIGN AND DEVELOPMENT

The Goldsworthy effort was completed during this quarterly period and will no longer be reported on in this line item.

The design and analysis effort associated with the Flight Experiment Analysis was reported on during this quarter in reference (a) and (b). Only the preliminary design layout effort and subsystem requirements document are continuing as required.

The design of the test apparatus associated with the Induction Fastening effort was completed during this quarter and reported in references (a) and (b). No further design or development effort is required at this time. Therefore, this effort will no longer be reported under this line item.

WBS 1.3 FABRICATION AND ASSEMBLY

The Goldsworthy effort was completed during this quarterly period. It will no longer be reported upon under this line item.

There is no effort associated with the Flight Experiment Analysis under this line item.

The test apparatus associated with the Induction Fastening effort was completed during this quarter and reported upon in reference (b). Therefore, it will no longer be reported upon under this line item.

WBS 1.4 TESTS

The Goldsworthy effort was completed during this quarter and reported on in references (a) and (b). This effort will no longer be reported under this line item.

There is no testing associated with the Flight Experiment Analysis under this line item.

Testing associated with Induction Fastening has been reported in reference (b) during this quarter. Test efforts are continuing and should be completed during the next reporting period. Additional data is discussed in enclosure (1).

CONCLUSIONS

Efforts at Goldsworthy Engineering Incorporated have been completed. We wait for further direction on the incomplete items noted above and in reference (b) or acceptance of the final report as noted above.

The Flight Experiment Analysis effort has proceeded satisfactorily, but will remain curtailed until further funding is made available to complete the effort.

The Induction Fastening effort is proceeding satisfactorily and remains within cost and schedule constraints.

RECOMMENDATION

NASA-MSFC respond to request for direction, acceptance and/or concurrence with the program observations made above in connection with:

- o Composite Beam Cap Fabricator development effort
- o Flight Experiment Analysis preliminary design effort

Continued close surveillance of all program elements by all cognizant program and project personnel.

Should you have any question with regard to the above, the enclosure or the SFDS program in general, please contact us.

Very truly yours,

GRUMMAN AEROSPACE CORPORATION

Walter K. Muench SFDS Program Manager

WKM:kf

cc: Distribution: NASA-MSFC

NASA-MSFC NASA-LARC

Grumman Goldswortny

CSS-SFDS-IROO1

DISTRIBUTION:	NASA-NSFC		
CODE	COPIES	ATTENTION	BLDG.
EH 43	1	Hill M. Walker	4711
EH 44	1	James H. Ehl	4711
EH 44	1	Charles N. Irvine	4711
EP 12	1	W. Prastholer	4610
EP 13	11	Erich E. Engler	4610
EM 34-13	1		
AS 24D	3	•	
AP 25G	1		
AT 01	1		
NAVPRO	1		Grumman, Plt. 30
DISTRIBUTION:	NASA-LaRC		•
CODE	COPIES	ATTENTION	BLDG.
387	2	Dr. John D. Buckley	1232A
DISTRIBUTION:	GRUMMAN		MAIL STOP
T. A. Guarino	1	•	B11-25
F. W. Haise	1		A13-25
D. A. Imgram	1		A13-25
A. Alberi	1		A09-25
J. Huber	2		A04-12
L.Junen	1		
A. Weyhreter	1		A01-10
H. Morfin	1		A09-25
W. Muench	4		A09-25
R. Panza	2		
L. Rooney	1		A02-25

DISTRIBUTION: COLDSWORTHY

G. W. Ewald 2

The state of the s

SFDS COMPOSITE BEAM CAP FABRICATOR

		ETT. T. T. T. T. T. A.		15	78			1.76		19	79).	
			SEP	ОСТ	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
MILESTONES	NA	ASA-MSFC REVIEWS SA-MSFC REPORTS UMMAN MGT REVIEW	MONT		0/30	PIENTATION DE TING	2	REV	7/28 7/28 7/7	7/8 5	FIN	SE	FINA	10/24
	W MGT	CONTRACT ADMIN	MAJOR	PROC	UREMEN'	MONITO	STRATIC	N WES	1.1.1.1 \$ WBS	1.1.1.2				
	PROGRAM WBS 1.1	PROJECT MGT WBS 1.1,2	CONTE		ERFORM									
WBS 1.0	DEVELOPMENT	STRUCTURAL MEMBER DEVELOPHENT WBS 1,2,1			Pk	AM CAP	MATER	N WBS	1.2.1.3	CTION			TION W	
FABRICATOR	DESIGN & DEV	FABRICATOR DESIGN WBS 1.2.2		FABR		BRICAT TH STENING	OR PRE	ASTIC S	OUT YS. DES THERM EPTS	IGN W	NAL BS 42.2 SYS. DES	IGN W	851.2.2. BS1.2.2 2.2.5 WBS1.	.4
CAP	ASCY 5 1.3	DETAIL PARTS WBS 1.3.1					THERM		LASTIC I	DIE SET	UP WE	20119	.1 WB\$1.5	.1.2
BEAM	FABE	ASSEMBLY WBS 1.3.2				FAS	TENING FA		DETAILS.			WEST	P WBS .3.1.8 BS 1.3.2	
COMPOSITE	STING BSI.4	BEAM CAP FABRICATOR DEVELOPMENT TESTS WBS1.4.1			l 4	, FIN	AL PRO	HERMO	SET	3	C FORK	RHING	WBS 1.4.1. WBS 1.4.1 WBS 1.4.1	3.1.2
SFDS	WE	STRUCTURAL ELEMENT \$NATERIALS TESTS W\$51.4.2					THERMO		MOSET	WBS I	PROCES			.Z 51.4.2.3 51.4.2.3

FIGURE 1 - Status of 12/15/79

SFDS FLIGHT EXPERIMENT ANALYSIS

1	FY 78	2					FY BB					
			CV 73						CV 88			
	AUG	3.6.	OCT	30	230	JAR	FEB	MAR	5	à dia	200	Ę
MILESTONES ATP.	4	A ORIENTATION BAS MEETING		Δ OTRLY	H.Y		A MHD TERM REVIEW	HO TERM REVIEW		OTRLY A	FIRAL	
MONTHLY		▶Ş	▶ 2	(Þ	Þ	ļ	٥	Þ			
FHIAL				Ž			D			DAAFT	> _	FIRM
PROGRAM MANAGEMENT SYSTEMS ARALYSIS		THE PARTY OF THE P	THE STATE OF THE S	ummm								
TASK 1 - SUBYSTEM REDNITS BOCUMENT SPACE SHUTLE PAYLOAD BAY HISTAL LATION SPACE ENVIRONMENT PERFORMANCE									U		ПП	
TASK 2 - DESIGN FLICHT STRUCTURE TRADE STUDHES RETENTION SYSTEM IN SHUTTLE					num.							
DYNAMIC ANALYSIS MASS PROPERTIES EVALUATE SERVICE LIFE	8			The state of the s				u n_		n		
TASK 3 – OUTPUT DATA PREL MMHARY DESIGN DAAWING MASS DATA AMAL YEES & REPORTS	B]	Uni	П	
TASK 4 - OTHER WEIGHT REDUCTION AMEAS SUBSYSTEM REVIEW & AMALYSIS				-					Π			

Figure 2 Status 12/15/79

SCHEDULE FOR INDUCTION WELDING OF COMPOSITES

-	+	Ď	√						<u> </u>	•		T	T	U	\dashv
6		Review			Ider -							_			
0		V	A12/17		CFE K										
Z		5	<u>\$</u>		Receive GFE Welder										
6	,	Orientation							3			3			
-	+	-0-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-				8	<u>_</u> _ <u>E</u>	3			3				7
								-							
							G								
					•		Pressure & Power Instrumentation	•	•		_		sure,	Weld Joint Evaluation (Static Tests and Photo Macrographs)	
,							nstrum			Unit)	d Configuration Selection	uo.	uation (Power, Time, Pressure, Frequency)	ts and	ے
						٥Ľ	ower I	ø	Unit and Calibrate	Testing (Prototype Unit)	on Sel	Evaluation/Selection	Time,	ic Tesi	Final Weld Configuration Selection
						ication Adaptor	e e P	cate Specimens	nd Cal	(Prot	gurati	tion/S	Power, y)	(Stati	on Se
				TESTS		ation	ressur	te Spe	nit ar	sting	Confle	valua	uation (Po Frequency)	tion	guratí
						abrica		brica	_		Weld		valuat nd Fre	Evalua)	Conf 1ç
				REENI	t-Up	and F	sh TI	ind Fa	Weld	rizati	Inary	Mater	ter Ev own ar	oint raphs	Weld
				PRELIMINARY SCREENING	Development Set-Up	1.1.1 Design and Fabr	1.1.2 Establish Time,	1.1.3 Order and Fabri	1.1.4 Install Welding	Weld Characterization	1.2.1 Preliminary Wel	Screen Material	Parameter Evalu Cool-Down and	Weld Joint E Macrographs)	Final
				LIMIN	elopm		 E	.3	I 4.1	Id Cha	2.1 P	1.2.2 \$	1.2.3 P	1.2.4 4	1.2.5
		ES	PORT	PRE PRE			1.1	1.1	1.1		-	1.	-	1.	1.
		MILESTONES	FINAL REPORT	TASK 1 PREL	1.1					1.2					
		MIL	FI	Ž Ž											

Figure 3 - Status 12/15/79

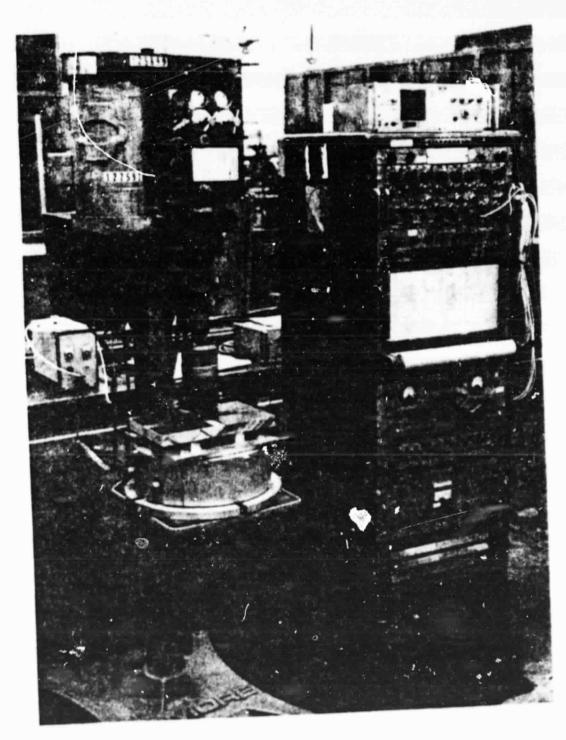
ENCLOSURE (1)

INDUCTION FASTENING

INDUCTION FASTENING OF GRAPHITE REINFORCED COMPOSITES

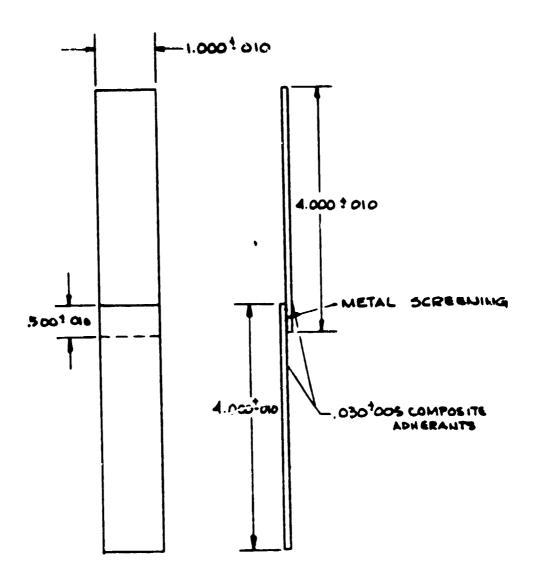
mented test stand. This test stand is comprised of a Dumore drill press (air over oil feed for variable applied loads) and a dynamometer to measure actual welding loads. The dynamometer output signal is fed to a Brush strip chart recorder for permanent record. The supplied LARC induction welder has typical operating characteristics of 120 K-Hertz and 60 watts power.

Continued testing has shown that the interface screening must be well impregnated with resin to ensure proper flow when bonding graphite/acrylic lap shear samples. Specimens have also been prepared from 0.030-inch thick graphite/polyethersulfone for future induction fastening evaluation. These samples will differ from the graphite/acrylic in that polyethersulfone film will be used in conjunction with steel screening at the lap shear interface.



INDUCTION FASTENING SYSTEM TEST STATION

OF POOR QUALITY



(

FIGURE - 2 - LAP SHEAR TEST CONFIGURATION